REMARKS

Reconsideration of this application based on the foregoing Amendment and the following Remarks is respectfully requested.

The applicants responded to the non-final third Office Action of June 5, 2003 with a Response Under 37 CFR 1.111 filed on September 8, 2003. The applicants did not further amend the claims at that time except to cancel claims 9, 10 and 13. Claims 1-8 and 11-12 remain pending in the application.

35 U.S.C. 112, Second Paragraph Rejections: Claims 2, 4, 6, 8 and 12

The Examiner has rejected claims 2, 4, 6, 8 and 12 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 recites in part the following:

"an effective refractive index difference parallel to the layers (Δn) being at least $7x10^{-4}$ and no greater than $3x10^{-3}$,"

The Examiner has changed the basis for the rejection of claim 2 and its dependent claims 4, 6, 8 and 12 under 35 U.S.C. 112, second paragraph. The Examiner now asserts that claim 2 is indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention for the following reason. The Examiner asserts that it is not clear within the language of claim 2 how the small difference in refractive index Δn is obtained.

In the applicants' arguments over the prior art, the applicants had referred the Examiner to the specification beginning on page 6, line 16, to page 8, line 2 and FIGS. 2(a)-2(c).

Now in the Response to Arguments, the Examiner now refers to page 6, line 24, which discloses the following:

> "By having five or more well layers of the MQW active layer and also having a p-AlGaInP cladding layer flat part *(note: item 105)* with a layer thickness of at least 300 nm, the value of Δn is made sufficiently small, thereby enabling sufficient broadening of the light distribution in the horizontal direction."

The Examiner asserts that claim 2 does not recite the thickness of the cladding but is capable of obtaining a small change in refractive index. The Examiner further asserts that therefore, any structure having five or more well layers and a cladding layer thickness of at least 300 nm will provide a small difference in the refractive index.

In response, the applicants interpret the Examiner's position with respect to the rejection of claim 2 under 35 U.S.C. 112, second paragraph, to be that, unlike claim 1, claim 2 does not recite any limitations regarding layer thickness of a p-AlGaInP cladding layer flat part. Therefore, the Examiner is concluding that it is unclear how small difference in refractive index Δn is obtained in claim 2.

Therefore, the applicants have amended claim 2 to relate the thickness of the second cladding layer to the effective refractive index parallel to the layers (Δn) by adding the following limitations:

--a layer thickness of a flat part of said second cladding layer having a current blocking structure being at least 300nm,

an effective refractive index difference parallel to the layers (Δn), said index resulting from said at least five well layers and said layer thickness of at least 300 nm, being at least $7x10^{-4}$ and no greater than $3x10^{-3}$--

As a result, the applicants respectfully request the Examiner to withdraw the rejection of claims 2, 4, 6, 8 and 12 under 35 U.S.C. 112, second paragraph.

Response to Arguments

In the Response to Arguments, the Examiner indicates that the applicants' arguments with respect to claims 1-8 and 11-12 have been considered but are moot in view of new grounds of rejection. In the non-final third Office Action, the Examiner cited four (4) references:

1. Iwamoto et al (US 6,487,226 - filed September 1, 1998 - issued November 26 2002);

2. Hatakoshi et al (US 6,031,858 - filed September 9, 1997 - issued February 29, 2000);

3. Tanaka et al (US 4,961,197 - filed April 14, 1989 - issued October 2, 1990), and

4. Honda et al (US 5,586,136 - filed July 1, 1994 - issued December 17, 1996).

Now the Examiner rejects claims 1-8 and 11-12 under 35 U.S.C. 103(a) as being unpatentable over Iwamoto et al in view of Nakatsu et al (US 6,265,732 - filed November 30, 1999 - issued July 24, 2001) and Honda et al.

Therefore, the Examiner has replaced the prior reference of Hatakoshi et al with Nakatsu et al. Although not cited in the above rejection, the Examiner also cites the previous reference of Tanaka et al against claims 2 and 12.

Claims 1 and 11:

The rejection of claims 1 and 11 is the same as the previous rejection of claims 1, 11 and 13, except for the following.

The Examiner concedes as before that Iwamoto et al does not disclose the cladding layer with a current blocking structure on the flat portion as having a carrier density in the range of at least $1x10^{17}cm^{-3}$ and no greater than $5x10^{17}cm^{-3}$.

However, the Examiner now asserts that Nakatsu et al, FIG. 10A, illustrates that a low carrier concentration of $3x10^{17}cm^{-3}$ (i.e., a carrier concentration of $< 3x10^{17}cm^{-3}$) will improve light output of the laser diode. The Examiner also asserts that column 14, lines 44-60, describes with respect to FIG. 9 a cladding layer 105 composed of layers 53 and 54 each having concentrations of $2x10^{17}cm^{-3}$ and $5x10^{17}cm^{-3}$, respectively.

Claims 2 and 12:

The rejection of claims 2 and 12 is the same as the previous rejection of claims 2, 9, 10 and 12, except for the following.

The Examiner concedes as before that Iwamoto et al does not disclose the cladding layer with a current blocking structure on the flat portion as having a carrier density in the range of at least $1x10^{17}cm^{-3}$ and no greater than $5x10^{17}cm^{-3}$.

However, the Examiner now asserts that Nakatsu et al, FIG. 10A, illustrates that a low carrier concentration of $3x10^{17}cm^{-3}$ (i.e., a carrier concentration of $< 3x10^{17}cm^{-3}$) will improve light output of the laser diode as described previously for claims 1 and 11 above.

As before, the Examiner concedes that Iwamoto et al and Nakatsu et al do not disclose a refractive index difference Δn of at least $7x10^{-4}$ and no greater than $3x10^{-3}$. However, as before, the Examiner asserts that Tanaka et al, column 4, lines 1-68, and column 5, lines 1-4, discloses controlling the refractive index (Δn) below the ridge stripe to within a range of $8x10^{-4}$ to $5x10^{-3}$.

The Examiner now also asserts that Tanaka et al, column 5, lines 1-4, discloses specifically:

> "Therefore, in a semiconductor layer device having a ridge stripe structure, stabilized self-sustained pulsation is obtained with high reproducibility by controlling the effective in refractive index difference between the area below the ridge stripe in the active layer and other areas within $8x10^{-4}$ -$5x10^{3}$ with the overall thickness of the active layer being 0.05-0.08 μm, and with the thickness of the portion of the upper cladding layer in which no ridge stripes are formed being 0.2-0.6 μm."

The Examiner asserts that therefore, Tanaka et al disclose controlling the refractive index (Δn) below the ridge stripe by maintaining the thickness of the upper cladding layer, where no ridge is formed (i.e. a flat part), to within the range of 0.2-0.6 μm (i.e., 200-600 nm).

Claims 3-8

The rejections of claims 3-8 are the same as the previous rejections of claims 3-8.

In response to all of the foregoing rejections, the applicants respectfully calls to the Examiner's attention that the applicants had argued *with respect to claims 1 and 11* by referring to the experimental results disclosed by FIGS. 2(a) to 2(c) and the discussion beginning on page 6, line 16, to page 8, line 2. The Examiner only refers to arguments of new and unexpected results in one sentence in the Response to Arguments, which states the following: "As understood by the examiner page 6, discloses a requirement of having five or more well layers and a cladding layer thickness of at least 300nm will provide a small difference in refractive index".

The Examiner appears to have directed his response to claim 2, and not claims 1 and 11. Therefore, the applicants respectfully maintain that the Examiner has not fully considered the applicants' arguments with respect to claims 1 and 11, which are as follows:

The new and unexpected results from the simultaneous application of the foregoing limitations of claims 1 and 11 are disclosed in FIGS. 2(a) to 2(c) of the drawings and the corresponding discussion beginning on page 6, line 16, to page 8, line 2 and the discussion of the experimental results beginning on page 9, line 22, to page 12, line 3.

Specifically, the combined limitations provide stable self-sustained pulsating operation at high temperatures. The self-sustained pulsating laser diode of the present invention of claims 1 and 11 achieves performance that is suitable for

application to optical discs at a high temperature, and to application for DVDs for car navigation systems, and DVD-ROMs and the like for notebook personal computers. Together with the limitations on the number of active well layers and the cladding thickness, if the carrier density falls outside the range of at least $1x10^{17}cm^{-3}$ and no greater than $5x10^{17}cm^{-3}$ for claim 1 and no greater than $3x10^{17}cm^{-3}$ for claim 11, the self-sustained pulsating operation is weakened as clearly shown in FIGS. 2(a) to 2(c).

Page 10, lines 7-19, discloses that by making the number of quantum well layers 5 or greater and also making the p-AlGaInP cladding layer flat part thickness at least 300 nm so that the Δn is made small, it is possible to achieve sufficient broadening of the light distribution in the horizontal direction. If the p-AlGaInP cladding layer flat part carrier density is no greater than $5x10^{17}cm^{-3}$, it is possible to make the current distribution small in comparison with the light distribution in the horizontal direction, so it is possible to achieve sufficiently strong self-sustained pulsating operation at a high temperature, which was difficult to achieve in the past.

Page 11, lines 1-5, discloses that only with a construction within the limits indicated in the present invention does it become possible to achieve practical laser characteristics while enabling self-sustained pulsating operation at a high temperature, which not possible in the past (as evidenced by FIG. 2).

Iwamoto et al and Nakatsu et al do not disclose, teach or suggest the combination of the limitations recited by claims 1 and 11. In view of the new and unexpected results, one of ordinary skill in the art would not have been motivated to combine the teachings of Iwamoto et al with those of Nakatsu et al to achieve the present invention of claims 1 and 11. Even if one of ordinary skill in the art were

somehow motivated to combine the teachings of Iwamoto et al with those of Nakatsu et al, the hypothethical device resulting from such a combination would not yield the advantages of the present invention of claims 1 and 11.

With respect to claim 3, neither Iwamoto et al nor Nakatsu et al, taken alone or in combination, disclose, teach or suggest the limitations of claim 1. With respect to claims 5 and 7, neither Iwamoto et al nor Nakatsu et al nor Honda et al, taken alone or in combination, disclose, teach or suggest the limitations of claim 1.

Consequently, the applicants respectfully request that the Examiner withdraw the rejections of claims 1, 3, 5, 7 and 11 over the prior art.

With respect to claims 2, 4, 6, 8 and 12, as noted above, the applicants have amended claim 2 to relate the thickness of the second cladding layer to the effective refractive index parallel to the layers (Δn) to overcome the rejection under 35 U.S.C. 112, second paragraph.

The experimental results in FIGS. 2(a) to 2(c) do not disclose directly the effective refractive index difference parallel to the layers (Δn). However, as noted above, page 10, lines 7-11, discloses that by making the number of quantum well layers 5 or greater and also making the p-AlGaInP cladding layer flat part thickness at least 300 nm so that the Δn is made small, it is possible to achieve sufficient broadening of the light distribution in the horizontal direction. Therefore, the specification discloses that the effective refractive index Δn parallel to the layers is functionally equivalent to the number of quantum wells and the layer thickness of the flat part of the cladding layer.

Claims 2 and 12 recite an effective refractive index difference parallel to the layers (Δn) being at least $7x10^{-4}$ and no greater than $3x10^{-3}$, and a carrier density in

a flat part of said second cladding layer having a current blocking structure being at least $1x10^{17}cm^{-3}$ and no greater than $5x10^{17}cm^{-3}$ for claim 2 and less than $3x10^{17}cm^{-3}$ for claim 12.

Page 12, lines 3-17 discusses the experimental results regarding this property, indicating that when a value of the refractive index parallel to the layers, inside and outside the stripe (Δn) is larger than $3x10^{-3}$, an optical confinement in a lateral direction becomes too strong so that any self-sustained pulsating operation cannot be generated or if generated, self-sustained pulsating operation is very weak so that it cannot (be) practically used. On the other hand when a value of the refractive index parallel to the layers, inside and outside the stripe (Δn) is less than $7x10^{-4}$, a lateral mode control cannot be effective so that it cannot be used as LD (laser diode).

Therefore, since the effective refractive index Δn parallel to the layers is functionally equivalent to the number of quantum wells and the layer thickness of the flat part of the cladding layer, the applicants maintain that neither Iwamoto et al nor Nakatsu et al nor Tanaka et al, taken alone or in combination, disclose, teach or suggest the combined limitations of claims 2 and 12 which provide the same new and unexpected results illustrated in FIGS. 2(a) to 2(c) and the specification beginning on page 6, line 16, to page 8, line 2, as discussed previously with respect to claims 1 and 11.

In view of the new and unexpected results, one of ordinary skill in the art would not have been motivated to combine the teachings of Iwamoto et al with those of Nakatsu et al and Tanaka et al to achieve the present invention of claims 2 and 12. Even if one of ordinary skill in the art were somehow motivated to

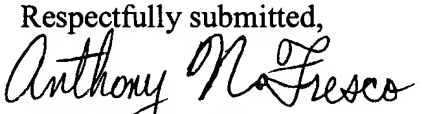
combine the teachings of Iwamoto et al with those of Nakatsu et al and Tanaka et al, the hypothetical device resulting from such a combination would not yield the advantages of the present invention of claims 2 and 12.

With respect to claim 4, neither Iwamoto et al nor Nakatsu et al nor Tanaka et al, taken alone or in combination, disclose, teach or suggest the limitations of claim 2. With respect to claims 6 and 8, neither Iwamoto et al nor Nakatsu et al nor Tanaka et al nor Honda et al, taken alone or in combination, disclose, teach or suggest the limitations of claim 2.

Consequently, the applicants respectfully request that the Examiner withdraw the rejections of claims 2, 4, 6, 8 and 12 over the prior art.

The foregoing amendments and remarks establish the patentable nature of all of the claims remaining in the application, i.e., claims 1-8 and 11-12. No new matter has been added. Wherefore, early and favorable reconsideration and issuance of a Notice of Allowance are respectfully requested.

Respectfully submitted,



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